Claims

What is claimed is:

1. A cooling system for an electric motor, comprising:

a cooling duct formed between a cooling jacket and a separate component surface, the separate component surface defining at least a portion of a wall of the cooling duct, the cooling duct being configured to direct a cooling liquid along at least a portion of the separate component surface and draw heat from the electric motor;

an inlet port in fluid communication with the cooling duct, the inlet port being configured to receive the cooling liquid to introduce the cooling liquid to the cooling duct; and

an outlet port in fluid communication with the cooling duct.

2. The cooling system of claim 1, wherein the separate component surface is an outer surface of a stator within the cooling jacket.

3. The cooling system of claim 2, wherein the cooling duct is spirally disposed thereby causing the cooling liquid to move at least partially in an axial direction of the motor along the outer surface of the stator.

4. The cooling system of claim 3, wherein the cooling jacket includes three cooling grooves formed in the cooling jacket, the three grooves forming the ducts.

5. The cooling system of claim 4, wherein the ducts are connected at intersections.

6. The cooling system of claim 1, wherein the separate component surface is an exterior sleeve disposed about the cooling jacket.

7. The cooling system of claim 6, wherein the cooling duct is spirally disposed thereby causing the cooling liquid to move at least partially in an axial direction of the motor along the outer surface of the stator.

8. The electric motor of claim 6, further including:

an annular ring formed in the cooling jacket; and

passages extending from the ring to an operating region defined at least in part by the cooling jacket.

9. The electric motor of claim 8, wherein the annular ring is in fluid communication with the cooling ducts.

10. The electric motor of claim 9, wherein the passages are configured to direct a cooling liquid onto end windings of the stator.

11. The electric motor of claim 10, further including a deflector formed at the end of at least one passage, the deflector being configured to direct the spray of the cooling liquid onto the end windings of the stator.

12. An electric motor, comprising:

a cooling jacket having an inner surface with at least one cooling groove; and

a stator disposed within the cooling jacket, the stator having an outer surface in contact with at least a portion of the inner surface of the cooling jacket, wherein the cooling groove and the outer surface of the stator form a cooling duct,

wherein the cooling groove is spirally disposed such that the cooling duct is configured to direct a cooling liquid at least partially in an axial direction of the motor.

13. The electric motor of claim 12, wherein the cooling jacket includes three cooling grooves.

14. The electric motor of claim 13, wherein the grooves are connected at intersections.

15. The electric motor of claim 12, wherein the at least one cooling groove has a groove width, and the distance between adjacent turns of the at least one cooling groove is a land width, and the groove width to land width ratio is between a ratio range of 2 to 3 and 3 to 2.

16. The electric motor of claim 12, further including at least one fluid passage configured to inject the cooling liquid into an operating region at least partially defined by the inner surface of the cooling jacket, wherein the stator is disposed within the operating region.

17. The electric motor of claim 12, further including at least one fluid passage configured to inject a cooling liquid onto at least one of the stator and a rotor within the stator.

18. An electric motor, comprising:

a cooling jacket having an outer surface with at least one cooling groove;

an exterior sleeve disposed around the cooling jacket, the exterior sleeve and the cooling groove defining a cooling duct; and

a stator disposed within the cooling jacket, the stator having an outer surface in contact with at least a portion of the inner surface of the cooling jacket.

19. The electric motor of claim 18, further including passages in the cooling jacket configured to inject the cooling liquid into an operating region at least partially defined by the inner surface of the cooling jacket, wherein the stator and a rotor are disposed within the operating region.

20. The electric motor of claim 19, further including an annular ring formed in the cooling jacket, the annular ring having passages extending from the ring to an operating region defined at least in part by the cooling jacket.

21. The electric motor of claim 20, wherein the annular ring is in fluid communication with the cooling ducts.

22. The electric motor of claim 21, wherein the passages are configured to direct a cooling liquid onto end windings of the stator.

23. The electric motor of claim 22, further including a deflector formed at the end of at least one passage, the deflector being configured to direct the spray of the cooling liquid onto the end windings of the stator.

24. The electric motor of claim 18, wherein the at least one cooling groove is spirally disposed and has a groove width, and the distance between adjacent turns of the at least one cooling groove is a land width, and the groove width to land width ratio is between a ratio range of 2 to 3 and 3 to 2.

25. An electric motor, comprising:

a cooling jacket having an inner surface defining an operating region;

a stator disposed at least partially within the operating region, the stator having an inner and outer surface;

a rotor disposed within the stator, the rotor being configured to rotate within the stator;

at least one fluid passage configured to inject a cooling liquid into the operating region to cool the stator and rotor.

26. The electric motor of claim 25, further including an annular ring formed in the cooling jacket, the at least one fluid passage being configured to direct fluid from the annular ring into the operating region.

27. The electric motor of claim 26, further including a cooling groove formed in the cooling jacket, the annular ring being in communication with the cooling groove.

28. The electric motor of claim 25, further including an end plate attached at an end of the electric motor, the end plate having an annular ring formed therein, the fluid passage being configured to direct fluid from the annular ring into the operating region.

29. The electric motor of claim 28, further including a spiral cooling groove formed in the cooling jacket, the spiral cooling groove being in contact with the stator.